Montana Department of
ENVIRONMENTAL QUALITY

DRAFT 7.1

Carrying Out a Substantial and Widespread Economic Analysis for Individual Nutrient Standards Variances

AND

Guidelines for Determining if a Waste Water Treatment Facility Can Remain at a Previous General Variance Concentration

June 2012

Prepared by:
Water Quality Planning Bureau, Water Quality Standards Section
Montana Department of Environmental Quality
1520 E. Sixth Avenue
P.O. Box 200901
Helena, MT 59620-0901

WQPBWQSTR-002

Suggested citation: Montana Department of Environmental Quality, 2012. Draft - Carrying out a Substantial and Widespread Economic Analysis for Individual Nutrient Standards Variances. Helena, MT: Montana Dept. of Environmental Quality

TABLE OF CONTENTS

Table of Contents i
List of Figures i
Acronyms iii
1.0 Introduction 1
2.0 The Evaluation Process for Individual Variances: Public-sector Permittees 1
2.1 Substantial and Widespread Economic Impacts: Process Overview 1
2.2 Completing the Substantial and Widespread Assessment Spreadsheet 3
2.3 Determining the Target Cost of the Pollution Control Project 4
3.0 The Evaluation Process for Individual Variances: Private-sector Permittees 5
3.1 Substantial and Widespread Economic Impacts: Process Overview 6
3.2 Completing the Substantial and Widespread Assessment Spreadsheet 6
3.3 Cost-cap (or other solution) for Private Entities 7
4.0 Guidelines for Determining if a Wastewater Treatment Facility Can Remain at the Previous General Variance Concentration(s) 8
4.1 Methods for Demonstrating Insignificant Environmental Improvement/Progress Towards Attaining the Standard 8
4.2. Net Environmental Benefit 9
5.0 References 10

DRAFT

LIST OF FIGURES

Figure 2-1. Sliding scale for determining cost cap based on a community's secondary score 5

DRAFT

ACRONYMS

Acronym	Definition
DEQ	Department of Environmental Quality (Montana)
EPA	Environmental Protection Agency (US)
LMI	Low to Moderate Income
MCA	Montana Code Annotated
MHI	Median Household Income

DRAFT

DRAFT

1.0 INTRODUCTION

Montana law allows for the granting of nutrient standards variances based on the particular economic and financial conditions of a permittee (§75-5-313 [1], MCA). These variances, referred to as individual nutrient standards variances ("individual variances"), may be granted on a case-by-case basis because the attainment of the base numeric nutrient standards is precluded due to economic impacts, limits of technology, or both. Individual variances may only be granted to a permittee after the permittee has made a demonstration to the Department that adverse, significant economic impacts would occur, the limits of technology have been reached, or both, and that there are no reasonable alternatives to discharging into state waters. The Department documents this assessment process here. It was developed in conjunction with the Nutrient Work Group and an earlier, informal working group (the Nutrient Criteria Affordability Advisory Group, which met between September 2008 and April 2009). It is modeled after a U.S. Environmental Protection Agency's (EPA) process (U.S. Environmental Protection Agency, 1995); however, Montana's process departs from EPA's in several substantive ways. This document outlines the specific data requirements, tests, and procedures by which the Department will determine if an individual variance is to be granted (or not) due to the potential for significant and widespread economic impacts.

This document also outlines guidelines for determining when a wastewater treatment facility can remain at the previous general-variance concentration requirements when the Department has updated those requirements per §75-5-313 [7][b], MCA. These guidelines are presented in **Section 4.0** of this document.

DRAFT

2.0 THE EVALUATION PROCESS FOR INDIVIDUAL VARIANCES: PUBLIC-SECTOR PERMITTEES

Methods outlined below are Montana's modifications to methods presented in U.S. Environmental Protection Agency (1995). If adverse substantial and widespread economic impacts to a community trying to comply with base numeric nutrient standards are demonstrated, the facility upgrade cost-cap will be determined via a sliding scale as proposed by EPA in its September 10, 2010 memo "EPA Guidance on Variances", reference No. 8EPR-EP.

In taking this approach, the Department has assumed that most permittees who cannot comply with the base numeric nutrient standards (DEQ-12, Part A) would pursue a general variance (DEQ-12, Part B). Therefore, it is only permittees for whom significant economic impacts would occur even at the general variance treatment levels that would likely request individual variances. As such, for communities with secondary scores (discussed further below) of 1.5 or lower, the cost cap for the upgrade would be set at 1.0% of median household income (MHI), including existing wastewater fees. The Nutrient Work Group has indicated that 1.0% of MHI is an acceptable cost cap for a community to expend on wastewater treatment where economic hardship due to meeting base numeric nutrient standards has been demonstrated. Higher Secondary scores would lead to a higher MHI cost cap.

2.1 SUBSTANTIAL AND WIDESPREAD ECONOMIC IMPACTS: PROCESS OVERVIEW

The following is an overview of the steps required to carry out a substantial and widespread economic analysis for a public-sector permittee. The evaluation can be undertaken directly in an Excel spreadsheet

template which contains instructions (see **Section 2.2**). The template is called "PublicEntity_Worksheet_EPACostModel_2012.xlsx" and is available from the Department.

Step 1: Verify project costs and calculate the annual cost of the new pollution control project.

Step 2: Calculate total annualized pollution control cost per household (manifested as an increase in the household wastewater bill).

Steps 3-5: The Substantial Test

Step 3: Calculate and evaluate the Municipal Preliminary Screener score based on the town's Median Household Income. This step identifies communities that can readily pay for the pollution control project.

Note: If the public entity passes a significant portion of the pollution control costs along to private facilities or firms, then the review procedures outlined in Chapter 3 of EPA (1995) for 'Private Entities' should also be consulted to determine the impact on the private entities.

Step 4: Apply the Secondary Test. This measurement incorporates a characterization of the socio-economic and financial well-being of households in the community. It comprises five evaluation parameters which are then averaged to give the secondary test score for a given community. A secondary score can range from 1.0 to 3.0.

Note: The ability of a community to finance a project may be dependent upon existing household financial conditions within that community.

DRAFT

Step 5: Assess where the community falls in the substantial impacts matrix. This matrix evaluates whether or not a given community is expected to incur substantial economic impacts due to the implementation of the pollution control costs. If the applicant can demonstrate substantial impacts, then the applicant moves on to the widespread test. If the applicant cannot demonstrate substantial impacts, then they will not perform the widespread test; they will be required to meet the base numeric nutrient standards, or may request a general variance if they can discharge at the general variance concentrations defined in Department Circular DEQ-12, Part B.

Note: The evaluation of substantial impacts resulting from compliance with base numeric nutrient standards includes two elements; (1) financial impacts to the public entity as measured in Step 3 (reflected in increased household wastewater fees), and (2) current socio-economic conditions of the community as measured in Step 4. Governments have the authority to levy taxes and distribute pollution control costs among households and businesses according to the tax base. Similarly, sewage authorities charge for services, and thus can recover pollution control costs through user's fees. In both cases, a substantial impact will usually affect the wider community. Whether or not the community faces substantial impacts depends on both the cost of the pollution control and the general financial and economic health of the community.

Step 6: The Widespread Test

Step 6: If impacts are expected to be substantial, then the applicant goes on to demonstrate whether or not the impacts are expected to be widespread

.

Note: Estimated changes in socio-economic indicators as a result of pollution control costs will be used to determine whether widespread impacts would occur.

Step 7: Final Determination of Substantial and Widespread Economic Impacts

Step 7: If widespread impacts are also demonstrated, then a permittee is eligible for an individual variance after having demonstrated to the Department that they considered alternatives to discharging (including but not limited to trading, land application, and permit compliance schedules). If widespread impacts have not been demonstrated, then the permittee is not eligible for an individual variance (however, the permittee may still receive a general variance if they can comply with the end-of-pipe treatment requirements thereof).

2.2 Completing the Substantial and Widespread Assessment Spreadsheet

Detailed steps for completing the substantial and widespread cost assessment are found in the spreadsheet template "PublicEntity_Worksheet_EPACostModel_2012.xlsx" available from the Department. Readers should refer to that spreadsheet, as it is self explanatory and instructions are found throughout. Below are a few additional details which may help clarify some of the steps:

1. Start at the far left tab of the spreadsheet ("Instructions [Steps to be Taken]") and review the instructions. They are the same steps outlined in **Section 2.1** above, but in more detail. Proceed to subsequent tabs to the right, making sure not to skip any of worksheets A through F.
2. Summarize the project on Worksheet A.
3. Detail the costs of the project on Worksheet B.
4. Calculated the annual cost per household of existing and expected new water treatment costs on Worksheet C.
5. On Worksheet D, carefully read the text in blue and compare it to the results from the MHI test and the community's Low to Moderate Income (LMI) level. Based on this screener, the evaluation will either terminate (i.e., it has been shown that the water pollution control is clearly affordable), or will continue to the secondary tests on the next tab which is Worksheet E[1].
6. On Worksheet E, note the linkages to websites and phone numbers where the information requested can be obtained. Then use this information to fill in Worksheet F where a secondary score is calculated.
7. The next tab, 'Substantial Impacts Matrix', shows if the community has demonstrated substantial impacts (or not). Those that have clearly demonstrated substantial impacts as well as those that are 'borderline' move on to the widespread tests.
8. On the 'DEQ Widespread Criteria' tab, complete the four descriptive questions. Then, complete the six primary questions and determine the outcome as to whether impacts are widespread. If still unclear, complete the additional secondary questions and again evaluate.
9. In order to be eligible for an individual variance, both substantial and widespread tests must be satisfied.

[1] The Department appended the LMI test to EPA's Municipal Preliminary Screener at this step in the process. This was done in order to address communities in which the income distribution is skewed such that there is a large proportion of high- and low-income individuals, but less in the middle near the median household income. As modified, the test should assure that such communities will move on to the more detailed secondary tests.

10. If substantial and widespread impacts are demonstrated, refer to **Section 2.3** below to determine the percentage of median household income that the community is expected to pay towards the pollution control project.

2.3 Determining the Target Cost of the Pollution Control Project

If a permittee has demonstrated that substantial and widespread economic impacts would occur if they were to comply with the base numeric nutrient standards, and there are no reasonable alternatives to discharging, then the cost the permittee will need to expend towards the pollution control project will be based on a sliding scale (**Figure 2-1**). The cost cap is determined as a percentage of the community's MHI, and the key driver of the cost cap is the secondary test (secondary score) calculated in **step 4** of **Section 2.1.**

For example, a community has demonstrated that substantial and widespread economic impacts would occur from trying to comply with the base numeric nutrient standards, and there were no reasonable alternative to discharging. If the permittee's average secondary score from the secondary tests was 1.5, then the annual cost cap for the pollution control project (including current wastewater fees) would be the dollar value equal to 1.0% of the community' MHI at the time that the analysis was undertaken (see blue line, **Figure 2-1**). This 1.0% would include existing wastewater costs plus new upgrades. If this community was already paying 1.0% or greater MHI for its wastewater bill, then no additional monies would be spent (and no additional upgrades would occur) under the individual variance.

The percentage of a community's MHI—as determined by the 'sliding scale' in **Figure 2-1**—would translate to the final wastewater bill that the community would pay after the upgrade. For example, a community with 10,000 households has a MHI of $40,000/year, and the sliding scale table indicates that 1.0% MHI needs to be expended on the pollution control project. To receive the individual variance, the per-household wastewater bill for the community would need to become, on average, $400 per year ($33.33 per month), because $400 is 1% of MHI in that community. If the average household in this community currently has a wastewater bill that is $300 per year ($25.00 per month), then a bill increase of $100 per year per household on average would be warranted to reach $400 per year or 1% MHI. Multiplying $100/year in an increased wastewater bill by the number of households on the system (10,000) provides the total annual dollar value available to be expended towards construction, operations, and maintenance of the wastewater upgrade. In this hypothetical case, that amounts to $1 million (10,000 X $100) that could be spent per year on an upgrade project. The upgrade itself may be significantly more than $1 million in initial capital costs, but the annualized payback of capital costs plus O&M costs of the upgrade could not be more than $1 million per year. If the current wastewater bill of this town was already $400 or higher, then no additional change would be expected (i.e., no further system upgrade would be required).

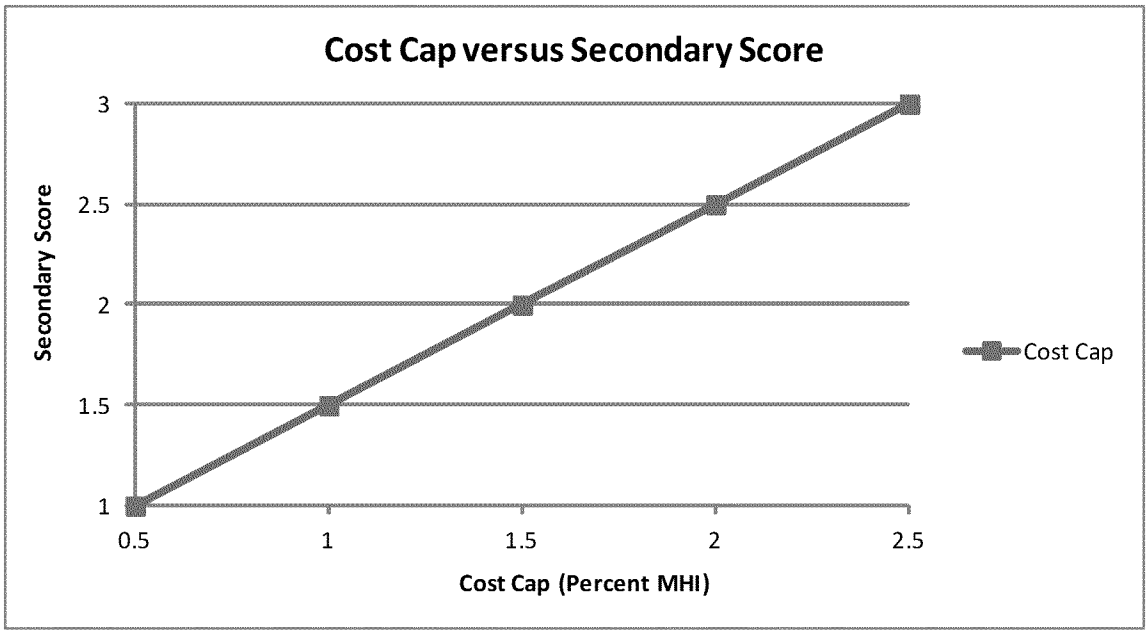

Figure 2-1. Sliding scale for determining cost cap based on a community's secondary score. The horizontal axis represents percentages of a community's median household income (MHI) that the community would be expected to expend towards the pollution control project as a function of the secondary score shown on the vertical axis.

It should be noted that the final cost of the engineering project may not exactly match the dollar value associated with the percent MHI determined via **Figure 2-1** (i.e., the actual project cost could be somewhat lower or somewhat higher than the dollar value equivalent for the percent MHI of the community in question). Engineers should view the dollar value equivalent of the MHI derived from **Figure 2-1** as a target, to help select the most appropriate water pollution control solution for the community. In order to accommodate actual engineering costs for the project, the Department will provide flexibility around the dollar value arrived at via **Figure 2-1**, subject to final Department approval.

When the level of treatment required has been established and accepted by the Department, it will be adopted by the Department following the Department's formal rule making process and documented in Circular DEQ-12, Part B.

3.0 The Evaluation Process for Individual Variances: Private-Sector Permittees

Methods outlined below are almost identical to those presented in U.S. Environmental Protection Agency (1995). If adverse substantial and widespread economic impacts to a private entity trying to comply with nutrient standards are demonstrated, the facility upgrade will be determined via approaches discussed in **Section 3.3.**

3.1 Substantial and Widespread Economic Impacts: Process Overview

The following is an overview of the steps required to carry out a substantial and widespread economic

analysis for a private-sector permittee. The evaluation can be undertaken directly in an Excel spreadsheet template which contains instructions (see **Section 3.2**). The template is called "PrivateEntity_Worksheet_EPACostModel_2012.xlsx" and is available from the Department.

Step 1: Verify Project Costs and Calculate the Annual Cost of the Pollution control project to the private entity.

Step 2: Substantial Test. Run a financial impact analysis on the private entity to assess the extent to which existing or planned activities and/or employment will be reduced as a result of meeting the water quality standards. The primary measure of whether substantial impact will occur to the private entity is profitability. The secondary measures include indicators of liquidity, solvency, and leverage.

Step 3: Widespread Test. If impacts on the private entity are expected to be substantial, then the applicant goes on to demonstrate whether they are also expected to be **widespread** to the defined study area.

Note: Estimated changes in socio-economic indicators in a defined area as a result of the additional pollution costs will be used to determine whether widespread impacts would occur.

Step 4: Final Determination of Substantial and Widespread Economic Impacts. If both substantial and widespread impacts are demonstrated, then a permittee is eligible for an individual variance after having demonstrated to the Department that they considered alternatives to discharging (including but not limited to trading, land application, and permit compliance schedules). If widespread impacts have not been demonstrated, then the permittee is not eligible for an individual variance (however, the permittee may still receive a general variance if they can comply with the end-of-pipe treatment requirements thereof).

DRAFT

3.2 Completing the Substantial and Widespread Assessment Spreadsheet

Detailed steps for completing the substantial and widespread cost assessment are found in the spreadsheet template "PrivateEntity_Worksheet_EPACostModel_2012.xlsx" (available from the Department). Readers should refer to that spreadsheet, as it is self explanatory and instructions are found throughout. Detailed steps for private sector entities are also found in Chapter 3 of U.S. Environmental Protection Agency (1995). Below are a few additional details which may help clarify some of the steps:

1. Start at the far left tab of the spreadsheet ("Instructions [Steps to Take]") and review the instructions. They are the same steps outlined in **Section 3.1** above. Proceed to subsequent tabs to the right, making sure not to skip any of the worksheets.
2. Summarize the project on Worksheet A.
3. There are no worksheets B through F on the private test.
4. The next worksheet is G where one details the costs of the project.
5. In the next tab, carefully read the 'Substantial Impact Instructions'.
6. In worksheets H through L, the four main substantial tests are presented. For these tests, profit and solvency ratios are calculated with and without the additional compliance costs (taking into consideration the entity's ability to increase its prices to cover part or all of the costs). Comparing these ratios to each other and to industry benchmarks provides a measure of the

impact on the entity of additional wastewater costs. For profit and solvency, the main question is how these will be affected by additional pollution control costs. The Liquidity and leverage measures look at how a firm is doing right now financially, and how much additional financial burden they could take on.

7. In the Tab entitled "Substan.Impacts_Determined", instruction is given as to how to interpret the results from the 'Substantial' tests in worksheets H through L.
8. If a 'Substantial ' finding is made, then proceed on to the next tab. If it is not made, then a variance will not be given.
9. On the 'DEQ Widespread Criteria' tab, complete the descriptive questions. Then, complete the primary questions and determine the outcome as to whether impacts are widespread. If still unclear, complete the secondary questions and again evaluate.
10. In order to be eligible for an individual variance, both substantial and widespread tests must be satisfied.
11. If both substantial and widespread impacts are demonstrated from additional pollution control costs, see **Section 3.3** below.

3.3 Cost-cap (or other solution) for Private Entities

U.S. Environmental Protection Agency (1995) provides very little guidance as to what financial expenditure should be made towards water pollution control when a private firm has demonstrated substantial and widespread impacts would occur if they complied with the standards. U.S. Environmental Protection Agency (1995) only states that "…if substantial and widespread economic and social impacts have been demonstrated, then the discharger will not have to meet the water quality standards. The discharger will, however, be expected to undertake some additional pollution control."

DRAFT

In cases where substantial and widespread economic impact has been demonstrated per methods outlined here in **Section 3.0**, the Department expects that in most cases the discharger (and their engineers) will propose to the Department some level of effluent improvement beyond that which they are currently doing, but less stringent that the general variances concentrations (which are now in statute at §75-5-313, MCA, and which will later be adopted as Department rules in 2016). A likely scenario would be that the discharger could implement a treatment technology one level less sophisticated than that required to meet the general variance concentrations. Basic definitions for different treatment levels are found in Falk et al. (2011); through 2016 the general variance requirement for dischargers > 1 MGD corresponds to level 2. When the discharger and the Department have come to agreement on the level of treatment required, the treatment levels will be adopted by the Department following the Department's formal rule making process, and documented in Circular DEQ-12, Part B.

4.0 Guidelines for Determining if a Wastewater Treatment Facility Can Remain at the Previous General Variance

CONCENTRATION(S)

The Department is required to review, and update as needed, the treatment requirements associated with the three general variance categories found at §75-5-313[5][b], MCA. The main principle that the Department must use to update (i.e., make more stringent) the statute-defined concentrations is that more cost effective and efficient treatment technologies have become available (§75-5-313 [7][b], MCA). The Department will carry out the determinations every 3 years as part of the water quality standards triennial review, and will update the category concentrations and requirements if more cost effective and efficient treatment technologies, relative to 2011, are available. However, circumstances may arise where, for a specific discharger, it may not make sense to move to the new, lower general variance concentration(s) at the time they are updated by the Department.

In order to remain at a previous general variance concentration, a permittee will need to demonstrate to the Department that (1) moving to the updated general variance concentration would not result in a net environmental improvement or material progress towards attaining the standards, and (2) it would cause more environmental damage than it would remedy[2]. The second of these conditions is essentially a determination of "net environmental benefit". The purpose of this section is to provide guidelines for the types of information the Department would need to permit a discharger to remain at the previous general-variance treatment levels, based on the two sets of conditions listed.

4.1 METHODS FOR DEMONSTRATING INSIGNIFICANT ENVIRONMENTAL IMPROVEMENT/PROGRESS TOWARDS ATTAINING THE STANDARD

DRAFT

Two major approaches may be used to establish that upgrading a wastewater facility to an updated general variance level would not result in significant environmental improvement or material progress towards attaining the standard:

1. Simulations based on mechanistic computer models

2. Demonstration of use support based on empirical data

Simulation Based on Mechanistic Computer Models. The Department will consider mechanistic model results that demonstrate that the lowering of one nutrient (e.g., TP) without lowering of the other would achieve essentially the same water quality endpoint (i.e., equivalent movement towards the water quality goal), subject to Department approval of the model and the model's parameterization. Modeled endpoints may include changes in water quality (pH, dissolved oxygen, etc.), and benthic and phytoplankton algae density. The Department encourages the use of the QUAL2K model (Chapra et al., 2010) but may consider results from other water quality models as well. Modeled nutrient reduction

[2] NEW RULE I (6) states: "A permittee who has already received a general variance is not required to further treat the facility's discharge to an updated (lower) general variance concentration adopted by the department if it can be demonstrated that achieving the lower concentration would not result in net environmental improvement, or would not result in material progress towards attaining the base numeric nutrient standard, and would cause more environmental harm than remaining at the previous general variance concentration." This corresponds to laws at the federal level governing the granting of variances from water quality standards. 40 CFR 313 (10)(g)(3) states that "Human caused conditions or sources of pollution…would cause more environmental damage to correct than to leave in place".

scenarios can vary in each case, but scenarios based on the five treatment levels described in Falk et al. (2011)—which represent steps in biological nutrient removal technologies—are encouraged by the Department.

The state of the art in computer water quality/algal growth modeling is such that nutrient co-limitation and community interaction of river flora is poorly simulated (or is not simulated at all). Models often treat algal growth dynamics in streams and rivers as though the algae were a monoculture (which is not the case). Because of the uncertainties in model simulations, the Department will require specific monitoring (per NEW RULE I [6][a]) for dischargers that are permitted to remain at a previous general variance concentration based on a mechanistic computer model output. The intent of the monitoring is to corroborate (or refute) the computer simulated results. At a minimum, growing season benthic-algae sampling will be required for a reach of the river downstream of the permittee's mixing zone, to be established in coordination with the Department. If the base numeric nutrient standard for the river in question was developed based on another water quality endpoint (for example, pH), then data collection must also include that parameter. Data collection will follow Department SOPs. If the collected data and the computer modeling results corroborate one another, then a reach-specific base numeric nutrient standard may be in order. Any reach-specific nutrient standard so determined may be adopted by the Board of Environmental Review under its rulemaking authority in §75-5-301(2), MCA.

Demonstration of Use Support Based on Empirical Data. Permittees may begin at any time to collect nutrient concentration, benthic and phytoplankton algae, and other water quality data in the receiving waterbody downstream of their mixing zone. In cases where the base numeric nutrient standard for the waterbody were developed using a specific water quality endpoint (for example, pH), data collection must include that parameter. Data collection shall follow Department SOPs. Permittees are strongly encouraged to coordinate with the Department on study design and data collection protocols upfront, to assure that the data will be acceptable to the Department when the time comes for evaluating the outcomes. Subject to Department approval, these data may be used to demonstrate that remaining at the previous general-variance treatment level (assumed here to have been achieved by the permittee) was adequate to support beneficial uses of the waterbody. If the collected data conclusively indicate that beneficial uses of the waterbody are fully supported, then a reach-specific base numeric nutrient standard may be in order. Any reach-specific nutrient standard so determined may be adopted by the Board of Environmental Review under its rulemaking authority in §75-5-301(2), MCA.

DRAFT

4.2. Net Environmental Benefit

NEW RULE I (6) requires that, in order for a permittee to remain at a previous general variance treatment level, a demonstration must be made that (1) an upgrade to the new general variance concentration would not results in net environmental improvement and (2) would cause more environmental harm than remaining at the previous treatment level. Per (2), the Department does not want to see substantive contributions to one form of pollution (air, noise, greenhouse gases, etc.) resulting from actions to address water pollution if those actions may only minimally reduce the water pollution problem in question. This section addresses the requirements associated with the later requirement.

Permittees must provide the Department approximate estimates of the capitol costs, and operations and maintenance costs, which would have been required in order to upgrade the facility to the new general variance concentrations. The intent is to demonstrate that there were substantial savings in capitol costs, materials, fuel, and energy by opting *not* to upgrade the facility. Capitol costs saved would

not include design-related work and overhead. Operations and maintenance cost saved should be estimates of fuel and/or electrical consumption, and other materials (e.g., chemicals). Permittees are not required to carry out a complex analysis comparing the relative economic or social value of one resource (the stream or river) vs. another (e.g., air quality) and then trying to quantify the relative savings. Rather, the Department wants a straight-forward quantification of cost savings associated with the key factors of concern (fuel and electrical consumption, and routine materials such as chemical additions).

5.0 REFERENCES

Chapra, S.C., Pelletier, G.J., and Tao, H. 2010. QUAL2K: A Modeling Framework for Simulating River and Stream Water Quality, Version 2.11: Documentation and Users Manual.

Falk, M.W., J.B. Neethling, and D.J. Reardon, 2011. Striking a Balance between Wastewater Treatment Nutrient Removal and Sustainability. Water Environment Research Foundation, document NUTR1R06n, IWA Publishing, London, UK.

U.S. Environmental Protection Agency. 1995. Interim Economics Guidance for Water Quality Standards - Workbook. U.S. Environmental Protection Agency. Report EPA-823-B-95-002.

DRAFT